

# FCH47N60NF

## N-Channel SupreMOS® FRFET® MOSFET

600 V, 45.8 A, 65 mΩ

### Features

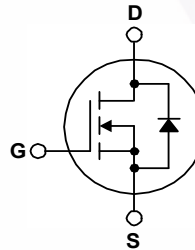
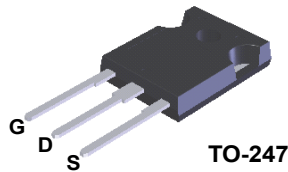
- 650 V @  $T_J = 150^\circ\text{C}$
- Typ.  $R_{DS(on)} = 57.5\text{ m}\Omega$
- Ultra Low Gate Charge (Typ.  $Q_g = 240\text{ nC}$ )
- Low Effective Output Capacitance (Typ.  $C_{oss(eff.)} = 420\text{ pF}$ )
- 100% Avalanche Tested
- RoHS Compliant

### Application

- Solar Inverter
- AC-DC Power Supply

### Description

The SupreMOS® MOSFET is Fairchild Semiconductor's next generation of high voltage super-junction (SJ) technology employing a deep trench filling process that differentiates it from the conventional SJ MOSFETs. This advanced technology and precise process control provides lowest  $R_{sp}$  on-resistance, superior switching performance and ruggedness. SupreMOS MOSFET is suitable for high frequency switching power converter applications such as PFC, server/telecom power, FPD TV power, ATX power and industrial power applications. SupreMOS FRFET® MOSFET's optimized body diode reverse recovery performance can remove additional component and improve system reliability.



### MOSFET Maximum Ratings $T_C = 25^\circ\text{C}$ unless otherwise noted.

Symbol	Parameter	FCH47N60NF	Unit
$V_{DSS}$	Drain to Source Voltage	600	V
$V_{GSS}$	Gate to Source Voltage	$\pm 30$	V
$I_D$	Drain Current	- Continuous ( $T_C = 25^\circ\text{C}$ )	45.8
		- Continuous ( $T_C = 100^\circ\text{C}$ )	28.9
$I_{DM}$	Drain Current	- Pulsed (Note 1)	137.4
$E_{AS}$	Single Pulsed Avalanche Energy	(Note 2)	2926
$I_{AR}$	Avalanche Current	(Note 1)	15.3
$E_{AR}$	Repetitive Avalanche Energy	(Note 1)	3.7
dv/dt	MOSFET dv/dt		100
	Peak Diode Recovery dv/dt	(Note 3)	50
$P_D$	Power Dissipation	( $T_C = 25^\circ\text{C}$ )	368
		- Derate Above $25^\circ\text{C}$	2.94
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to +150	$^\circ\text{C}$
$T_L$	Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Seconds	300	$^\circ\text{C}$

\*Drain current limited by maximum junction temperature.

### Thermal Characteristics

Symbol	Parameter	FCH47N60NF	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.34	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	40	

## Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FCH47N60NF	FCH47N60NF	TO-247	Tube	N/A	N/A	30 units

## Electrical Characteristics $T_C = 25^\circ\text{C}$ unless otherwise noted.

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
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### Off Characteristics

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = 1\text{ mA}, V_{GS} = 0\text{ V}, T_C = 25^\circ\text{C}$	600	-	-	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 1\text{ mA}$ , Referenced to $25^\circ\text{C}$	-	0.78	-	$\text{V}/^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 480\text{ V}, V_{GS} = 0\text{ V}$	-	-	10	$\mu\text{A}$
		$V_{DS} = 480\text{ V}, V_{GS} = 0\text{ V}, T_C = 125^\circ\text{C}$	-	-	100	
$I_{GSS}$	Gate to Body Leakage Current	$V_{GS} = \pm 30\text{ V}, V_{DS} = 0\text{ V}$	-	-	$\pm 100$	nA

### On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250\ \mu\text{A}$	3	-	5	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{ V}, I_D = 23.5\text{ A}$	-	57.5	65.0	m $\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 40\text{ V}, I_D = 23.5\text{ A}$	-	52	100	S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 100\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	-	4600	6120	pF
$C_{oss}$	Output Capacitance		-	195	260	pF
$C_{rss}$	Reverse Transfer Capacitance		-	3.0	5.0	pF
$C_{oss}$	Output Capacitance	$V_{DS} = 380\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	-	108	-	pF
$C_{oss(eff.)}$	Effective Output Capacitance	$V_{DS} = 0\text{ V to } 380\text{ V}, V_{GS} = 0\text{ V}$	-	492	-	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	$V_{DS} = 380\text{ V}, I_D = 23.5\text{ A}, V_{GS} = 10\text{ V}$ (Note 4)	-	121	157	nC
$Q_{gs}$	Gate to Source Gate Charge		-	23	-	nC
$Q_{gd}$	Gate to Drain "Miller" Charge		-	47	-	nC
ESR	Equivalent Series Resistance(G-S)	$f = 1\text{ MHz}$	-	0.9	-	$\Omega$

### Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 380\text{ V}, I_D = 23.5\text{ A}, R_G = 4.7\ \Omega$ (Note 4)	-	34	78	ns
$t_r$	Turn-On Rise Time		-	22	54	ns
$t_{d(off)}$	Turn-Off Delay Time		-	117	244	ns
$t_f$	Turn-Off Fall Time		-	4	18	ns

### Drain-Source Diode Characteristics

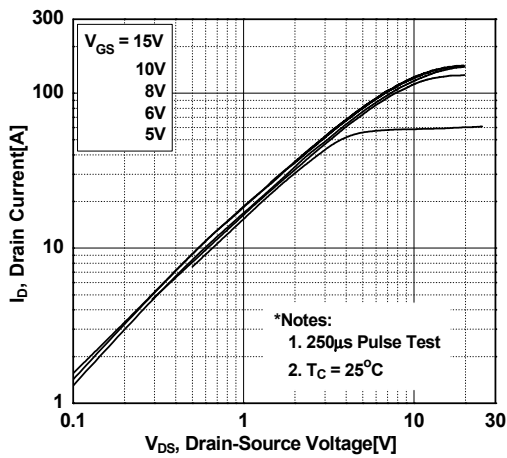
$I_S$	Maximum Continuous Drain to Source Diode Forward Current	-	-	47	A	
$I_{SM}$	Maximum Pulsed Drain to Source Diode Forward Current	-	-	141	A	
$V_{SD}$	Drain to Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_{SD} = 23.5\text{ A}$	-	-	1.2	V
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0\text{ V}, I_{SD} = 23.5\text{ A}$	-	169	-	ns
$Q_{rr}$	Reverse Recovery Charge	$di_F/dt = 100\text{ A}/\mu\text{s}$	-	1.3	-	$\mu\text{C}$

#### Notes:

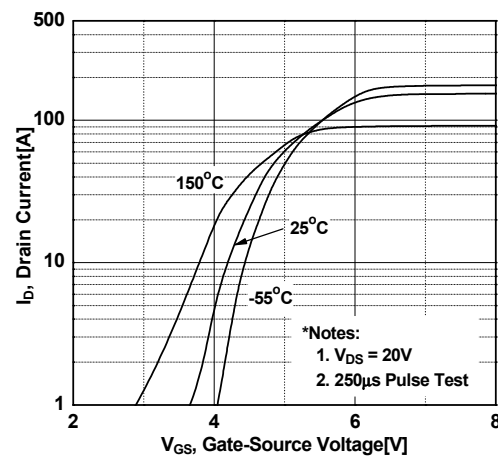
1. Repetitive rating: pulse-width limited by maximum junction temperature.
2.  $I_{AS} = 15.3\text{ A}, R_G = 25\ \Omega$ , starting  $T_J = 25^\circ\text{C}$ .
3.  $I_{SD} \leq 45.8\text{ A}, di/dt \leq 1200\text{ A}/\mu\text{s}, V_{DD} \leq 380\text{ V}$ , starting  $T_J = 25^\circ\text{C}$ .
4. Essentially independent of operating temperature typical characteristics.

## Typical Performance Characteristics

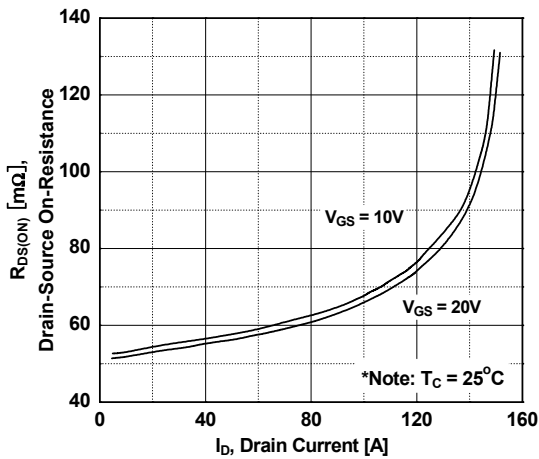
**Figure 1. On-Region Characteristics**



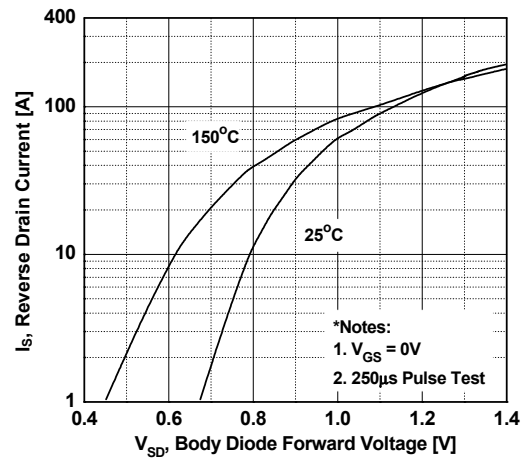
**Figure 2. Transfer Characteristics**



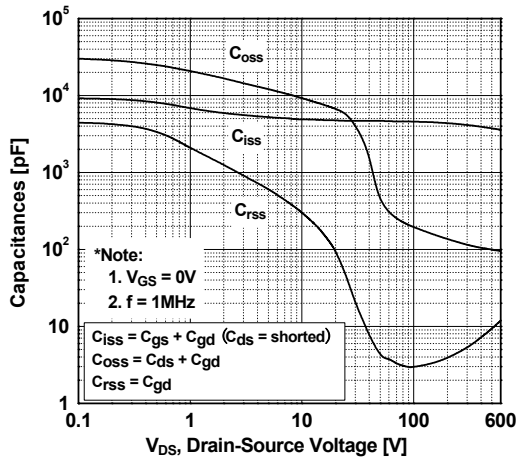
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



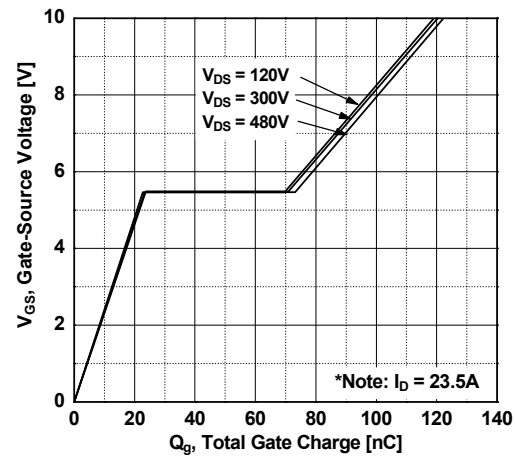
**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**



**Figure 5. Capacitance Characteristics**



**Figure 6. Gate Charge Characteristics**



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

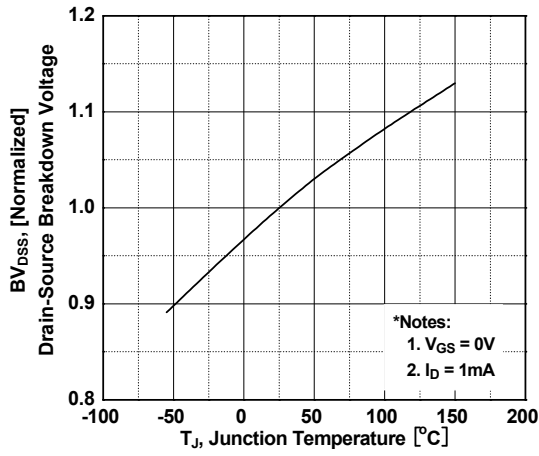


Figure 8. On-Resistance Variation vs. Temperature

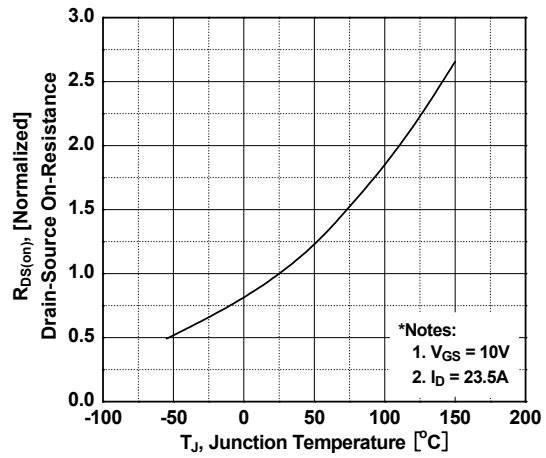


Figure 9. Maximum Safe Operating Area

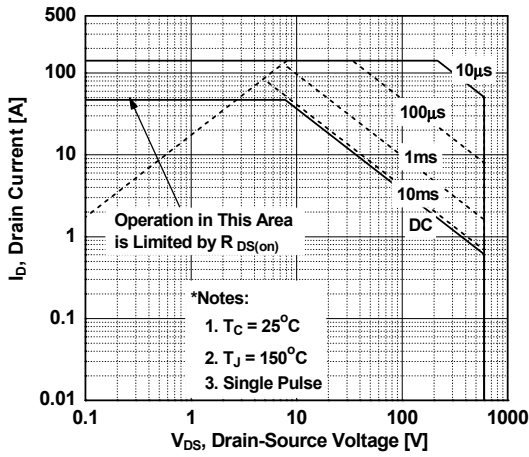


Figure 10. Maximum Drain Current vs. Case Temperature

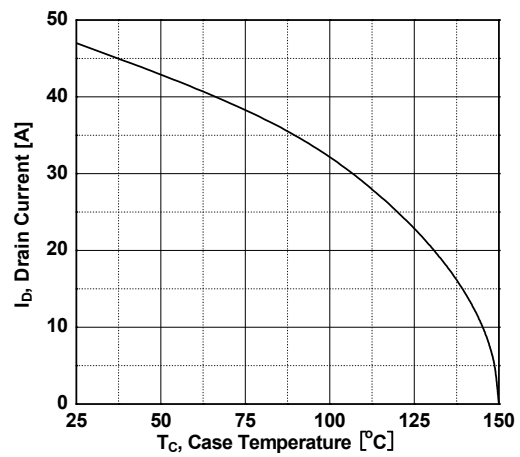
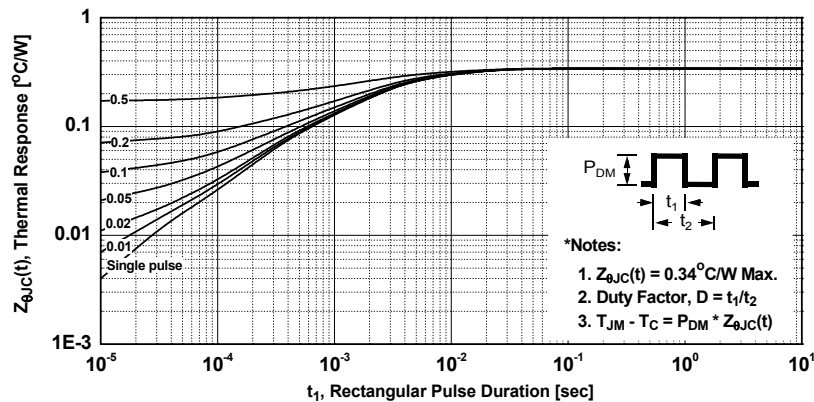
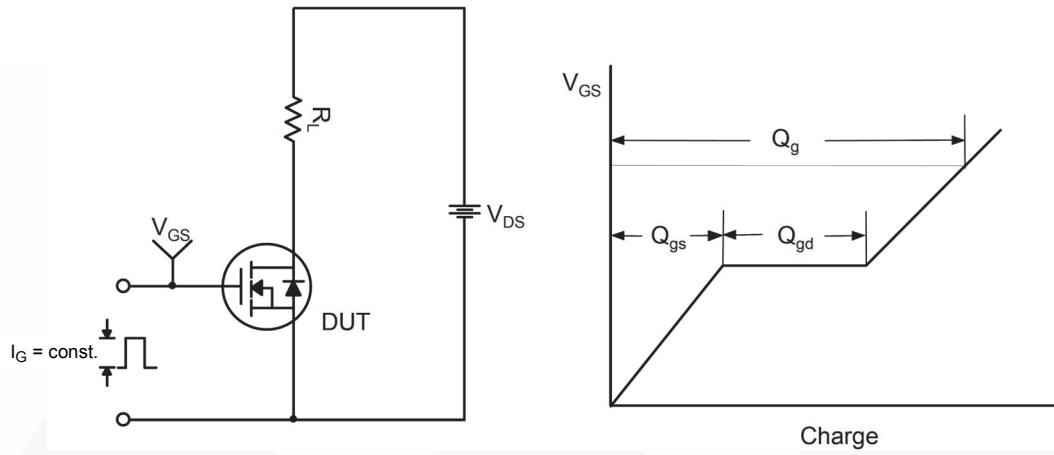


Figure 11. Transient Thermal Response Curve





**Figure 12. Gate Charge Test Circuit & Waveform**



**Figure 13. Resistive Switching Test Circuit & Waveforms**

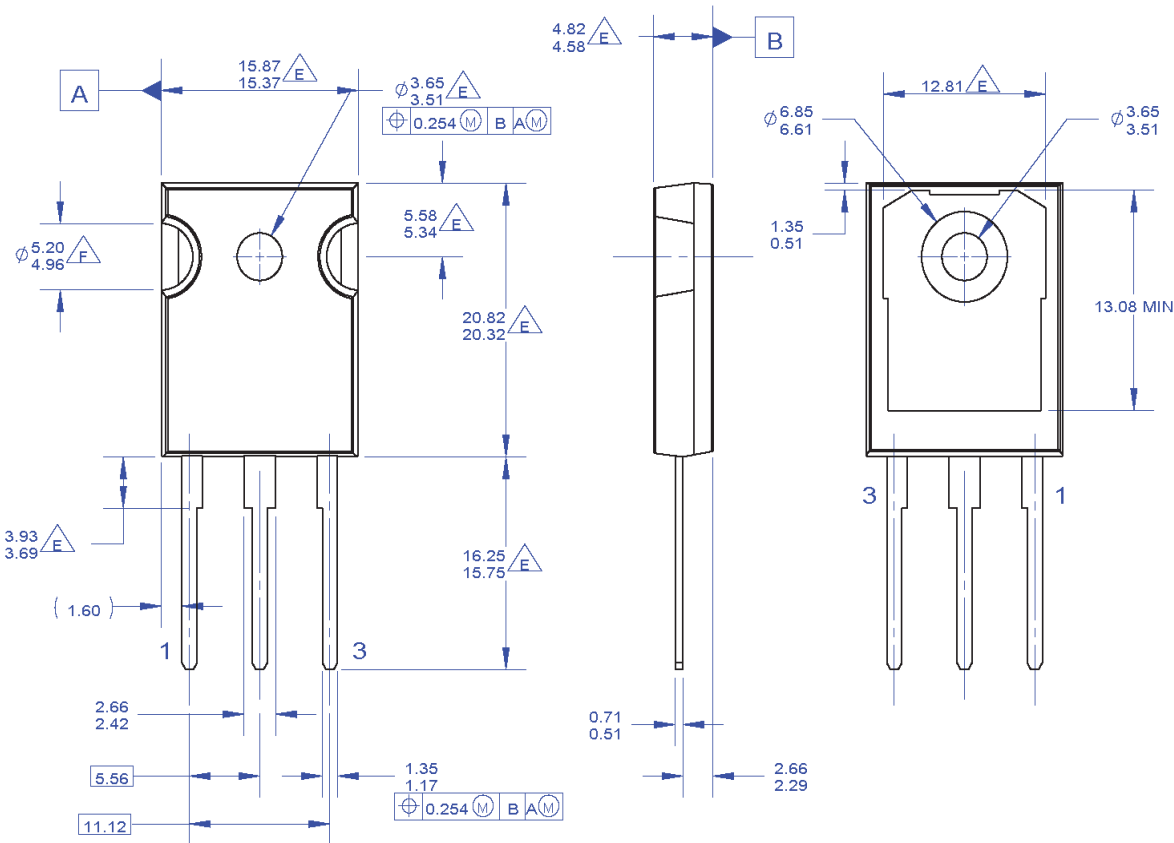


**Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms**



Figure 15. Peak Diode Recovery  $dv/dt$  Test Circuit & Waveforms

## Mechanical Dimensions



NOTES: UNLESS OTHERWISE SPECIFIED.

- A. PACKAGE REFERENCE: JEDEC TO-247, ISSUE E, VARIATION AB, DATED JUNE, 2004.
- B. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
- C. ALL DIMENSIONS ARE IN MILLIMETERS.
- D. DRAWING CONFORMS TO ASME Y14.5 - 1994

DOES NOT COMPLY JEDEC STANDARD VALUE

NOTCH MAY BE SQUARE

G. DRAWING FILENAME: MKT-TO247A03\_REV03

**Figure 16. TO-247, Molded, 3-Lead, Jedec Variation AB**

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| FACT®                    |                         |   | VisualMax™       |
| FAST®                    |                         |   | VoltagePlus™     |
| FastvCore™               |                         |   | XS™              |
| FETBench™                |                         |   |                  |
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Rev. I66